

Relating root causes to local risk conditions: A comparative study of the institutional pathways to small-scale disasters in three urban flood contexts

Abstract

The continued rise of global disaster losses pushes our attention yet further to the causal factors that drive risks, beyond the frame of standardised risk assessment models. A key gap in our understanding of the causality of disasters remains establishing how spatially and temporally distant factors – ‘root causes’ – drive local risk conditions. This is particularly the case for small-scale but high-impact disasters. This includes understanding the role that institutions play in influencing such pathways of risk production. This paper addresses this question using a holistic approach to risk analysis that links past drivers to contemporary conditions. We apply this in three case studies of coastal flood management in urban areas of differential size and integration within the European Union - Rethymno (Crete), Genoa (Italy) and St Maarten (Dutch Caribbean). The paper reveals the importance of local institutions in mediating the impacts of higher-level economic and political changes on local risks. It provides new empirical evidence of the relationship between austerity, institutional reform and local disaster risk reduction. The analysis supports a stronger causal epistemology of resilience to disasters but also leads to re-consideration of the institutional entry points for risk reduction, and the importance of considering context and trade-offs.

Keywords: *Flood Risk Management; Root Causes; Austerity; Disaster Risk Governance; Urban Resilience; Small Scale Disasters*

Highlights

- Risks are co-constructed between higher-level and local institutional pathways.
- Informal political institutions exert strong influence on local risk reduction.
- A risk assessment method integrates past causes with present to future conditions.
- Local agency for risk reduction requires action across scales, aware of trade-offs.

Introduction

25 years since the publication of ‘At Risk’, there is a long history of scholarship indebted to understanding the social vulnerabilities that drive disasters as well as the negative impacts of global environmental change. Such scholarship has long emphasised the need to understand the causal drivers of risk beyond hazard, and account for causal factors in risk assessments (Blaikie et al. 1994; Oliver-Smith et al. 2016). The importance of understanding and addressing how disasters are socially as well as physically constructed remains. This reflects a backdrop of rising global disaster losses despite the increased application of science and technology in disaster risk management. This is symptomatic of a continued need to address underlying vulnerabilities and their causes in analytical and applied work (White et al. 2001; Lemos and Tompkins 2008; Oliver-Smith et al. 2016). While the imperative for momentum is recognised in disaster risk reduction frameworks and processes, this needs to be supported by mechanisms for practice that better drive integration between risk reduction and broader development processes (Djalante and Lassa 2019). Existing risk assessment methodologies still largely overview current vulnerabilities, capacities and post-disaster conditions. While important, this stops short of investigating how risks and vulnerabilities arise (DKKV 2012). This limits the potential for risk and vulnerability reduction and drives a focus on short-term, partial policy solutions rather than on measures that could support sustainable reductions in disaster risk.

This paper reports on the application of a framework developed as part of the Preparing for Extreme and Rare Events in Coastal Regions (PEARL) project (2014-2018). The project aimed to provide a systematic assessment of the causal drivers of flood risk as part of the development of a holistic disaster risk management approach for coastal communities. This approach enabled conceptual interrogation of how global and national drivers interacted with local conditions in the context of small-scale disasters.

This responds to a long-standing gap in disasters studies about the pathways through which distant spatial and temporal conditions (or ‘root causes’) link to locally occurring risks, and how institutions function and interact within these pathways to mediate the influence of structural conditions on risk (Pelling 2003). This debate also has wider ramifications for climate change literatures driven by the question of how changing global conditions interact with locally expressing risks (Leichenko et al. 2010). Situating flood risk management within the co-evolving social and environmental system that shapes it, this paper also responds to calls from disasters scholars to broaden analysis from a focus on the legislation, policies, plans and procedures related to the management of hazards and disasters to the underlying socio-political and economic contexts within which management takes place (Tierney 2012; Scolobig 2017). It places disasters and disaster risk management in their broader development context, raising questions about the possibilities for transformative change (Thomalla et al. 2018).

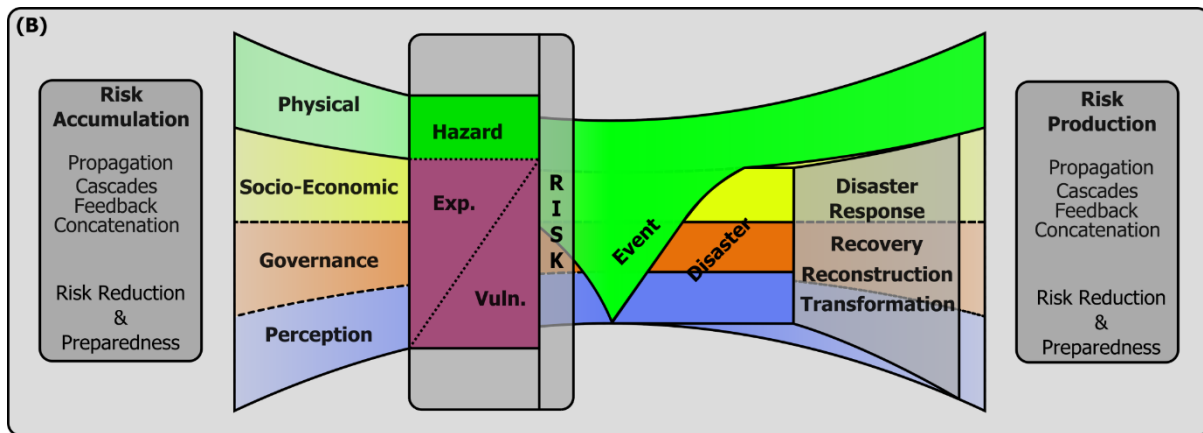
The study of small-scale but recurrent and high-impact events is often neglected. This is despite their demonstrated importance to local human development outcomes as well as accumulated and aggregated disaster losses and damages (Wisner and Gaillard 2009; Marulanda et al. 2010; Zaidi 2018). This analytic focus brings to the fore strong links to underlying social drivers including local governance (Zaidi 2018). However, the spatial and temporal dimensions of such drivers have yet to be systematically examined. Existing work identifies the key role of local actors as mediating institutions between local risk and loss and national and international influences. Local actors have acquired a central focus for resilience planning and the operationalisation of global goals for risk reduction and development, especially municipal government agencies and organised civil society (Fenton et al. 2017; Hardoy et al. 2018). Critical questions remain though as to how responsibilities for risk reduction should be structured across scales; how local capacities for resilience building have been shaped by contemporary economic and political change; and how far resilience theories – as a guide to action – promote an uncritical localisation of power (Joseph 2013; Welsh 2014).

Section 2 examines approaches to disaster risk causation, including the approach adopted for this paper, through the lens of governance, scale and systems. Section 3 discusses methodological approach and technique. Section 4 presents findings and discussion from three case study contexts of urban flood risk management influenced by European Union finance, regulation and governance. The conclusion draws together implications for research and practice.

2. Approaches to disaster risk causation and the role of governance

Local-scale manifestations of risk and vulnerability relate to wider contextual factors (Bohle 2001) and are produced in the complex interactions between physical and social systems (DKKV 2012; Huang et al. 2013). Within the disasters literature, systematic approaches to understanding these interacting causes of risk remain indebted to the ‘Pressure and Release’ (PAR) Model. This links the production of vulnerability to the production of hazard, explaining vulnerability creation through the relationship between distant spatial and temporal ‘root causes’ (or systemic conditions), intervening pressures and locally manifesting unsafe conditions (Blaikie et al. 1994; Pelling 2003). This has given rise to various models for ‘root cause analysis’ which operationalise the PAR model, including the Forensic Investigations of Disasters (FORIN) project, which aims to institutionalise causal investigation as part of disaster risk reduction practice (Oliver-Smith et al. 2016). These models and a derivation for the context of the PEARL project were reviewed in detail in Fraser et al. 2016. Critical elements of this derived framework, as shown in Fig.1, were that it was holistic, linking physical, economic, governance and psychosocial drivers to ongoing processes of risk reduction and creation through the production of hazard, exposure and vulnerability (risk). Hazard events give rise to disasters that unfold across and interact with social and political worlds. Core aspects of disaster risk management are nested within this context.

Fig. 1 The PEARL risk root cause analysis framework



Source: Fraser et al. 2016

The application of this framework in the context of small-scale disasters opens up conceptual questions about governance, scale and systems in explanations of risk causation. These relate back to the general model first proposed by the PAR. Governance has been emphasised as a key driver of risk (Oliver Smith et al. 2016; Ahrens and Rudolph 2006), but the institutional pathways which mediate the influence of broader structural changes on local risks have been much less detailed (Pelling 2003). Such pathways are recognised to involve informal as well as formal institutions, or the “socially shared rules...created, communicated and enforced outside of officially sanctioned channels” (Leftwich 2007, p.10). These range from spontaneous organisational arrangements (Green 2005; Blackburn 2014; Marks and Lebel 2015) to ad hoc shared norms and political cultures (Mauelshagen 2009). Less considered in the disasters literature are the different temporalities of institutional change, such as policy reforms, including the disaster management cycle. These can be fluid or more embedded, with the ordering of events important to the resulting outcomes (Mauelshagen 2009; Tierney 2012; Leftwich 2007; Pierson 2004). As discussed, the attention to small-scale disasters flags local governance as a pivot point within more widely scaled governance systems. Understanding this politics of scale and access builds on the original PAR model and its derivations (Sandoval and Boano 2014), but brings its own theoretical considerations.

2.1 Understanding scale: risk as globally and locally co-constructed

The Pressure and Release model depends on a vertically driven model of causation. This views the relationship between macro-level processes and local risks as one of globally driven constraint on local environments. This perspective is echoed in climate change adaptation scholarship concerned with the influence of global environmental change on local climate change governance and risks (Adger et al. 2009; Leichenko et al. 2010) and with the inter-relationship between global environmental change and the impact of contemporary economic and political changes, including global economic crisis and subsequent austerity programmes (Liverman and Vilas 2006; Eakin and Tompkins 2006; Wilson et al. 2014; Wright 2016). The impacts of the 2009 crisis and austerity on disaster risk management programmes have been much less well traced.

Conversely, accounts of local agency to manage risks have been critiqued for a lack of engagement with the impact of broader-scale shocks, and the implications of the spatial ‘stretching’ of policy decisions (Chelleri et al. 2015). As questions have been asked about the impacts of decentralisation on the local governance of disaster risk, there has been increasing attention to the ‘politics of scale’ in disaster risk management. This draws attention to the ways in which socially constructed and temporally fluid relationships between stakeholders more or less physically proximate to local contexts shapes responses at this scale (Fraser 2006; Blackburn 2014; Sandoval and Boano 2014; Paterson et al. 2017; Marks and Lebel 2015). As well as offering a theoretical route out of singularly localised conceptions of resilience, understanding the politics of scale in risk production reframes globally driven or rigidly

hierarchical accounts of the linkages between local risk and major global processes. These can be seen as mutually constitutive global-local interactions rather than global ‘structures’ touching down in ‘local’ contexts to be met by ‘local agency’ (Leitner and Miller 2007).

This view of scale is doubly productive in informing our understanding of the systemic interactions across physical and social domains through which risks occur. Systems approaches have been brought together with the Pressure and Release Model to enrich understanding of the complexity of causal interactions (e.g. Huang et al. 2013). However, the treatment of scale within systems retains a view of institutions as nested and hierarchical, and scale as functional and rigid (Newig and Moss 2017; Roland 2004). This can be re-framed through a politics of scale approach (Newig and Moss 2017; Paterson et al. 2017).

2.2 Between functionalism and contingency: towards a critical epistemology of disasters

Deepening conceptualisations of governance and scale, therefore, may shed greater light on the intervening institutional pathways that link international and national drivers with local risk conditions. Such analysis highlights the scalar co-production of disasters operating through power relations within shifting institutional configurations (Brenner 2001) of formal and informal institutions. It shows the ways in which this mediates access to and control over relevant resources, regulatory and governance structures. In the context of small-scale disasters, local actors appear as critical intermediaries and their role in determining root causes requires better exploration. The following sections trace the application of a holistic root cause framework for doing so. At a deeper level, this raises questions about our epistemology of disaster causation. On the one hand, the basic systems model of pressure and release has been challenged to go further in explaining both the non-linearity and discontinuities of the interlocking ‘systems of systems’ that drive disaster occurrence (Zaidi 2018). On the other, the ‘search for root causes’ is challenged by a view of disasters as created in place and time-dependent networks of physical and non-physical forces (Donovan 2017). This paper presents an approach that avoids both the implied functionalism of the systems approach and the contingency of the networks approach. It treats causation as both political and structural, open to systematic investigations that can identify interventions for social change (Storper and Scott 2016).

3. Methods: Using a comparative approach to understand the past causes of contemporary risk conditions

The research took place across three case study sites – St Maarten in the Dutch Caribbean; Genoa, Italy and Rethymno, Crete (see Fraser 2016; Scolobig 2017 and Mavrogenis 2016). This approach responded to a stated need to draw systematic conclusions about disaster causation and governance using comparative studies (Burby 2006; Handmer and Dovers 2007, Tierney 2012) whilst being sensitive to the influence of particular histories and cultures on causal factors (Alcántara-Ayala and Oliver-Smith 2019). The three contexts all experienced recent small-scale, recurrent flood events. They shared a history of tourism-led urban development, occurring from the beginning of the twentieth century in Genoa and in the post-war period in St Maarten and Rethymno. The in-migration and unplanned urbanisation that characterised such development was identified by stakeholders as highly significant to the formation of contemporary flood risk. Local political visions and narratives were largely oriented to the promotion of development and growth over sensitivity to risk reduction. However, each context had established local architectures for risk management and histories of local commitment to and investment in risk reduction. Difference between the case study sites emerged in the scalar location of power. Economically Genoa, Italy, was well integrated as a large, national port city and situated in a ‘core’ region of the EU (Magone et al. 2016). Rethymno, Crete, was situated in a ‘peripheral’ nation of the EU (ibid.) and economically marginal across all scales. St Maarten, in the Dutch Caribbean, was also economically dependent as a small island economy, and, from 2010, devolved but politically dependent on the Kingdom of the Netherlands. From 2010, its relationship to the EU has been as an

Overseas Country and Territory of the European Union (therefore not subject to EU regulation and no longer eligible for EU funds).

Data was primarily derived from semi-structured interviews. The framework displayed in Figure 1 was adapted as a thematic grid to represent both the time dimensions of the study (past, present and future relative to the date of the interviews) and the nature of the causes identified (physical, socio-economic and governance). A blank grid was used as a starting point to structure interviews, with participants asked to reflect on the causes of relevant, contemporaneous flood events, and relate their explanations of the causes to present and future risk conditions in each locale. This method for relating past causes to contemporary risk conditions marked a departure from earlier studies of disaster causation which have explained the past causes of single, past events (IRDR 2011).

The choice of events under discussion was determined by documentary analysis of the range of events occurring in the case studies in the recent past, as well as initial open discussions with knowledgeable stakeholders (such as specialist academics and government officials). As further details about causal pathways emerged, more detailed and locally specific questions were introduced to compare and triangulate stakeholder perspectives. Through asking about structural causes as well as decision-making processes that occurred across different organisations to prepare for, respond to and recover from particular disaster events, agency-structure interactions were revealed as part of a co-evolving system.

Contemporary narratives are perpetuated by particular knowledge systems, which change over time (Jeffers 2014). Questions about causation can be highly politicised and may elicit only partial answers in formal interview settings. We therefore sought to interview as many different types of stakeholder as we could (See Table 1). Requests for anonymity meant that we could only reveal the organisation within which we interviewed, and not further details about interviewees. In all case studies, we snowballed out from initial contacts derived through the PEARL project. Interviewees were selected based on their role and / or experience. As interviewees had differing knowledge and experience of different floods, we adapted the questions according to their most relevant experience. The interviews were in-depth, typically lasting 1-2 hours. Although the exact profile of the stakeholders we interviewed varied across the case studies, the commonality of the approach and method allow comparable findings to be displayed, as shown in Section 4.

Across all three case studies, initial documentary analysis drew on the site-specific academic and policy literatures. These were identified using searches for flood events occurring in the recent past as well as disaster risk management in the local and national contexts. Where relevant to our causal analysis, texts were then included in the body of evidence we coded and analysed against our framework (bearing in mind that such reports also represented particular forms of narrative construction, influenced by editorial styles and other organisational viewpoints, as above). The exact weight of the methods used in each case study varied. In Genoa, a vast existing literature was available, while stakeholder fatigue was high. The researcher therefore relied on telephone interviews but also a large-scale review of media articles. In St Maarten, a heavy reliance on oral culture and lack of written documents meant the analysis mainly focused on face-to-face interviews. While the construction of our data corpus varied in this way, the use of a common grid unified the findings, and in all cases, multiple methods provided a means of triangulation and verification.

Table 1: Methods by case study site

	Focal disaster events	Principal methods	Stakeholder types interviewed
Genoa, Italy	2011 and 2014 floods	17 semi-structured telephone interviews; document review of laws, technical reports from regional,	National, regional and municipal civil protection and environment agencies; Municipal urban

		provincial and municipal governments, urban, river basin and emergency plans, climate adaptation plans, research reports, academic articles, and relevant media reports, including more than 150 news articles published online between 2010 and 2015 relating to risk management and the 2011 and 2014 floods.	planning and communications; River basin authority; Sustainable education and citizens' participation office; NGOs; Specialist academics and lawyers; Centre on environmental monitoring.
Rethymno, Crete	Small-scale, recurrent annual flooding as experienced to 2015	17 semi-structured interviews corroborated with findings from a stakeholder workshop. Document review of academic publications and grey literature (technical and research studies and project reports).	National and local water resources and civil protection agencies and NGOs; Former Mayor; Port authorities; Hotel and restaurant owners; Local households.
Dutch St Maarten, Caribbean	2005 and 2014 floods	22 semi-structured interviews; document review of academic publications and grey literature, media articles and relevant websites.	Independent expert consultants; Government ministries and meteorological office; NGOs; Business sector bodies; Insurance companies; Port, Harbour and Marina companies

219

220 Each case study was limited by differential access to particular stakeholders caused by workload, staff
221 turnover, unexpected events and respondent fatigue. The findings also reflect the ability of stakeholders
222 to reflect on historic and future trajectories. The temporal horizon of the research was limited to that
223 articulated by interviewees. It therefore tended to confine to the recent (multi-annual) and medium-term
224 past (multi-decadal), with less perspective on the deep past (centennial). This nevertheless still allowed
225 for ample perspective on the pathways of influence from spatially distant to local events, as well as for
226 expressions of continuity and discontinuity in the past that went beyond what would have been possible
227 from a 'snapshot' of present risk conditions. It was also challenging for interviewees to articulate inter-
228 linkages stretching beyond their scope of vision. Interviews were therefore undertaken across different
229 spatial and jurisdictional levels of governance where possible.

230 The challenges revealed by the approach reflect the complexity of analysing cause-effect relations of
231 inter-linked drivers over scales and time, where temporal continuities and dis-continuities – and their
232 significance into the present and future – were not always detectable (Pierson 2004). As Sandoval and

Boano suggest, approaching scale as socially constructed from the local perspective outwards can facilitate making empirical connections between distant socioeconomic and political processes and disaster events (Sandoval and Boano 2014). Temporal discontinuity meant a need to reflect on the nature of changing contemporary conditions with stakeholders, as well as choosing carefully which events to study. Respondents felt it easier to comment on the causes and effects of management to recent than past events. The overall approach of using disaster events as the analytic ‘window’ through which to view underlying social processes was valuable as an interview technique to move respondents beyond broad-brush opinions and pre-existing conceptions. However, it needed to be considered that events (especially small-scale) produce highly localised impacts with differing initial or local causal pathways. In response, both 2014 Hurricane Gonzalo, which produced major consequences for the local marine sector, and flash floods in 2005, that affected hillside districts, were included in the St Maarten case study. The same was true for the Genoa case, which included the 2011 and 2014 flood events.

4. Findings and discussion

In practice, researchers modified the Figure 1 framework to accommodate stakeholder responses to it. Findings brought the psychosocial element of the framework into flood risk governance. This reflected the exclusion of household and community perceptions. The findings also drew together hazard, exposure and vulnerability as components of risk rather than mapping the drivers of each element separately. This responded to the interlinked nature of flood events that led to significant overlap between these drivers of risk and loss. As mentioned, in each case there were established local architectures for risk management that were vital sources of resilience, in particular in reducing losses to life. The analytic focus of the Figure 1 Framework on understanding the broader context for risk drivers tended to downplay this. However, the implications of the analysis for thinking about the conditions under which such agency occurred are discussed in Section 5.

i. Rethymno, Greece

Rethymno, a port town and regional commercial, administrative and cultural centre in Crete, Greece, with a population of around 40,000 residents, experienced flooding due to storm waves and flash floods. Wave overtopping in the harbour and wider coastal area disrupted port operations, damaged facilities and cargo, caused traffic problems and damaged coastal shops and restaurants. Adjacent recreational beaches were exposed to erosion. The table below summarises stakeholder viewpoints, as reported in 2015, on the causes of small-scale annual flood risk across the domains of the risk root cause analysis framework and over time.

Table 2: Risk Root Causes in Rethymno

Causes of risk	Past (Prior to 2015)	Present (2015)	Future (2015 onwards)
Physical	Exposure to strong winds; coastal location at confluence mountain streams; topography	As past	As past; Climate change induced changes in wind conditions and sea levels
Socio-economic	Rapid, unplanned urbanisation from 1970s; accompanied by social fragmentation; development interests override flood risk governance Decentralisation from 1960s fails to bring local resources National austerity policies from 2010 prevent the Rethymno Port	Continued lack of maintenance of structural protection and inability to undertake new infrastructural works alongside lack holistic risk governance.	In context of austerity, municipal agencies moving to undertake smaller-scale infrastructure works, drawing more strongly on the capacities of the non-governmental sector but also beginning to place greater emphasis on infrastructure

	Authority raising funds to reconstruct the old harbour and diminish the capacity of local civil protection.		maintenance and non-structural measures. Development visions for tourism as a counter to recession.
Governance	<p>Structural protection in place from 1990s due to EU funds. Dominant reliance on engineering solutions eclipses more holistic forms of risk governance - a background of party-based political clientelism precludes broader stakeholder involvement in local flood risk management, including greater public awareness raising and collaboration with volunteer groups.</p> <p>Institutional fragmentation across national agencies and between governance levels prevents any local impact of regulatory and governance measures through the EU Flood Directive (2007) and national platform for disaster risk reduction under the Hyogo Framework.</p> <p>2010 institutional reforms move power for risk management from local authorities to regional (sub-national) jurisdictions and away from local civil protection agencies to the fire brigade (where flood risk management loses priority to forest fires). EU funding is then targeted at this level. Responsibilities for hydraulic works are then unclear.</p>	Continued lack of maintenance of structural protection and inability to undertake new infrastructural works alongside lack holistic risk governance.	Harsh austerity conditions open up new possibilities for disasters governance by breaking with clientelistic party-based relationships and prompting the development of new social networks.

Source: Mavrogenis 2016, based on interviews and a stakeholder workshop undertaken in 2015.

The causal pathways that drove risk are clearly interlinked across the domains we outline. Importantly, the primacy of governance arrangements was marked, in shaping the scale and nature of flood impacts and a number of institutional pathways revealed. The convergence of austerity programmes from 2010 and the 2010 rescaling of government functions exerted a strong influence on the recent past. It exacerbated the already weak capacity of local actors to access EU funding for mitigation and maintenance works and to undertake protection. The local civil protection office in Rethymno reported having just one member of staff in 2015, while the regional office was also under-staffed and reliant on EU programmes supporting the wages of young professionals (Interview Civil Protection Agency 02/06/2015). The 2010 legal and administrative reforms left “no chance for pre-disaster planning” as all responsibilities went from local authorities, who focussed on all disaster types, to the fire brigade, focussed on forest fires (Interview Red Cross representative 08/06/2015).

By looking backwards from a contemporary starting point, the analysis also reveals the shifting politics of scale that influenced local risk management. Over the time periods identified by contemporary

stakeholders as relevant, there appeared no automatically felt effect of all governance scales in local risk management, or hierarchical order to their local influence. Prior to the 1990s, as put by the former Prefect, “We have always wanted to protect the old town and the city of Rethymno from disasters....but the problem was lack of money” (Interview 08/06/2015). In the 1990s, local agency, through a pro-active Mayor, was able to capitalise on the new availability of EU regional funding for risk reduction, an effective form of ‘scale jumping’. However, this local agency proved contingent and was later reversed by national reform programmes from 2010, in part a response to the EU and global economic crisis.

Critical from this ‘forensic’ analysis at the local scale was the influence of underlying and longer-running institutional conditions on the impact on local risks of changes in higher-level structural conditions. The tradition of clientelism and party politics was agreed by most interviewees to be among the major root causes of risk in Rethymno. Persistent clientelism prevented movement to more holistic risk governance models. An interviewee from a local volunteer group for civil protection explained how they were not supported by the local authorities, commenting, “Party politics are the main reason for the lack of support to the team of volunteers” (Interview 09/06/2015). This and other institutional conditions compounded the influence of austerity rather than being created by it. Interviews across the local, regional and national levels of government illustrated institutional fragmentation across national ministries and between the national, regional and local levels. This impeded the completion of EU infrastructural projects at the local level, for example, which required 25% national participation – exacerbating new resource constraints. The possibilities identified for change into the future included austerity’s impacts breaking clientelistic relationships at the local level. This raises questions about the immutability of institutional features and whether in the future sustained change in local flood risk management culture will be possible without a commensurate shift in scalar responsibilities and relationships to re-orient finance, regulation and governance support to the local level.

ii. St Maarten, Dutch Caribbean

Located in the Northern belt of the former Netherlands Antilles, the island of St Maarten represents a local-scale jurisdiction (size of approximately 60,000 inhabitants). Since 2010, it has been an autonomous country within the Kingdom of the Netherlands (with national responsibilities in all areas except foreign policy, defence and some judicial functions). The average recurrence of significant damage to residential and commercial areas from flooding is estimated at 2 years (Ministry of Public Health, Spatial Planning, Environment and Infrastructure 2015), associated with both hurricane conditions and local flood events during the rainy season. The table below summarises the drivers of risk as reported in 2015 through stakeholder accounts of the 2005 and 2014 floods.

Table 3: Risk Root Causes in St Maarten

Causes of risk	Past (Prior to 2015)	Present (2015)	Future (2015 onwards)
Physical	Location; topography; morphology (altered by storms and development over inland ponds, mangroves and sea outlets) leads to hazard impacts of hurricanes and localised flooding; small island status leads to resource constraint	As past – key moment for change storms of 1990s which lead to institutionalisation of DRM systems	Possible climate change impacts
Socio-economic	Colonial marginalisation constrains resources Physical landscapes altered through development from 1960s e.g.	As past – key moment for change 2010 devolution which alters access to resources from Netherlands and the EU	Future development vision centred on mass tourism

	infilling and dredging; demographic pressure results in unplanned urbanisation in hazardous areas; patterns of land ownership exacerbate erosion and impede emergency access; structural economic dependence on migrants creates vulnerabilities		
Governance	Colonial marginalisation leads to lack of administrative development Lack of oversight and enforcement of Dutch and local land and building regulation and lack of preparedness (beyond forecasting and warning) reflects political drive to develop and political interests in land ownership; patronage system means lack of political platform for risk reduction; lack of public sector capacity and strong civil society.	As past – key moment for change 2010 devolution, which compounds the weakness of the local political party system – leading to continued failure in strategic, long-term decision-making for risk reduction.	Suggested increased public accountability with devolution; plans for improvements to disaster risk management systems

Source: Fraser 2016 based on interviews undertaken in 2015 and documentary and media analysis.

In the St Maarten case, the mechanics of scale in governance differed to Rethymno but similarly occurred against the persistent blockage of local institutions. These prevented significant movement to risk-informed development and land use planning and moderated the impact of higher-level regulations. Despite local policies from the 1990s for beach and hillside protection and national legal regulation, recent decades were described as a development “free for all” by one government official (Interview Ministry of Public Housing, Spatial Planning, Environment and Infrastructure, 28/07/2015). According to a private sector representative, “Preparedness was never a priority, the priority was rebuilding and maintaining tourist numbers” (Interview St Maarten Trade and Hospitality Association, 07/08/2015). Against a backdrop of resource constraint as a small island, the relationship between the St Maarten government, the Kingdom of the Netherlands and the European Union strongly influenced access to resources for flood protection infrastructure. Prior to 2010, St Maarten’s integrated status as part of the Netherlands Federation enabled access to Dutch and EU development aid. This pre-financed infrastructure and social development projects that were not seen locally as an investment priority, such as water and sewage infrastructure, in places that were not a local political priority (because they lay outside the capital Philipsburg and the main tourist areas). This aid in part cushioned the effect of the 2009-2011 economic slump St Maarten experienced as a result of the 2008 global economic downturn. There was little reported impact of this downturn on disaster risk management reported by interviewees on the island in 2015-2016.

As Table 3 indicates, these scalar relationships were reconfigured with the vote for autonomy and the devolution of power to the local government in 2010. The vote lost St Maarten access to Dutch development aid and EU funding through the European Development Fund (as St Maarten became an Associate Member of the EU). A debt relief settlement with the Dutch imposed tight fiscal ceilings and restrictions on international borrowing. As one government official explained, “Now we have to be self-reliant and it is a huge challenge” (Interview Ministry of Public Housing, Spatial Planning, Environment and Infrastructure, 28/07/2015). Under new resource constraints, trade-offs between risk reduction and economic development objectives (noted by Paterson et al. 2017) driven by pre-existing local political interests in land development become more apparent, and compounded the influence of underlying economic development pathways. One government official reflected: “Cost is not our friend...but it is also a question of political choices” (Interview Ministry of Public Housing, Spatial Planning,

Environment and Infrastructure, 31/07/2015). In 2012-2014 a reported 30% of planned drainage projects were completed, but at the time of interviews in 2015 and 2016 none had been undertaken since 2014, after the government committed the available budget to purchase land instead.

iii. Genoa, Italy

The municipality of Genoa, North West Italy, differs significantly from both Rethymno and Dutch St Maarten in its larger jurisdictional size (cf. 600,000 inhabitants) but also its relative national economic importance, as the sixth largest urban centre in Italy and major seaport. The city has experienced an increase in the intensity of flood events in the past 50 years, causing casualties, evacuations, displacements and severe damage. The Bisagno river is of particular focus, flowing through the most urbanised part of Genoa, with around 100,000 inhabitants as well as associated economic and industrial activities. The table below summarises the drivers of risk as reported in 2015 through stakeholder accounts of the 2011 and 2014 floods.

Table 4: Risk root causes in Genoa

Causes of risk	Past (Prior to 2015)	Present (2015)	Future (2015 onwards)
Physical	Morphology of steep slopes and small coastal plains; erosion; short hydrological run off times; exacerbation through urbanisation process including limited funding for risk protection works.	As past; increased intensity of flood events	As past; More frequent drought periods and heavy rainfall with climate change
Socio-economic	Demographic growth until 1970; urbanisation unharmonised with risk planning; criteria for funding distribution for risk reduction penalises the region Austerity programmes from 2011 exacerbate the limited resources available for the public sector and human resources for risk reduction, and shift priorities away from risk mitigation at the local and regional scale	Lack of dataset/overview of allocated and transferred funding; limited human resources/personnel	Population ageing, immigration, gender and place of residence as main social vulnerability drivers Limited funding availability
Governance	Culture of post-hoc, emergency response funding Decentralisation from 1990s does not bring more local funding; Lack of implementation of structural measures	Despite policy changes following the 2014 floods Legal conflicts block the use of (already) limited monetary resources as well as project implementation; too much responsibility at local level/too little capacities and resources;	

	including extreme delays in reinforcing the banks of the Bisagno river.	anti-corruption measures slowing down the system; excessive number of authorities	
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Source: Scolobig 2017, based on interviews undertaken in 2015, documentary analysis and media analysis.

In Genoa, austerity conditions compounded pre-existing forms of institutional weakness, including budgetary and human resource constraints exacerbated by the large number of organisations with responsibilities in managing local disaster risk. As reported by an interviewee in the Regional Environment Agency, “in the past years the limited monetary resources available for the public sector affected risk mitigation very badly. For example in the regional council, the health sector was always considered a priority in comparison with the risk sector” (Interview 01/07/2015). In other words mainstreaming flood risk mitigation in decision making at the local and regional level proved to be an extremely difficult task in times of austerity.

However, a wide spectrum of interviewees (including representatives of the Regional Coastal Ecosystem and Water Management Team, International Centre on Environmental Monitoring, University experts, Municipal Urban Planning Office and Regional Environment Agency) maintained that one of the root causes of increased risk and vulnerability in Genova was the “risk mitigation stalemate”. Physical protection defences have not been built and flood risk remained extremely high. “The most serious problem as regards flood risk management in Genova is the risk mitigation stalemate. Notwithstanding the funding allocated for building structural mitigation works, little has been done to mitigate risk, even after events which caused several casualties” (Interview NGO Representatives 07/07/2015). Inability to improve physical measures reflected a local-level deadlock in the transfer and use of resources made available by higher levels. The implementation of flood risk management plans required by the European Floods Directive by the year 2015 standardised the basis for financial allocations at the national scale according to new risk maps, with favourable results for financial allocations to Genoa. Further, the 2011 and 2014 flood emergencies in Genoa prompted positive national-level policy change. A new governmental unit aimed at reducing hydrogeological risk was created; the criteria for distributing funding for risk mitigation among Italian regions changed (from the number of inhabitants/ region size to the risk levels); and the ‘Unblock Italy decree’ foresaw new urgent measures to reduce hydrological risks in municipalities.

Interviewees attributed stalemate to local effects of legal trials and reciprocal corruption accusations among the companies competing to undertake contracts or receive a tender for building protection works. After 2010, three trials (Liguria Tribunal, Lazio Tribunal, State Council Tribunal) prevented the implementation of physical risk mitigation measures. The rotation of Directors in charge of approving public spending — to avoid bribery — or the ‘anti-mafia certificate’ (a compulsory anti-corruption certificate necessary to undertake a contract for building protection works) also considerably slowed down the implementation of the projects. Interviewees from government and academia further articulated how this more recent development exacerbated long-standing institutional issues, such as over-regulation in disaster risk management, leading to decisional inertia because of responsibility overlaps and lengthy procedures.

iv. Discussion

The study’s approach to contextualising the broader conditions that drive risk, coupled with the new requirements of scale brought by a predominant focus on small-scale disasters, reveals *co-constructed institutional pathways* of risk reduction and creation. Through such pathways, structural change at higher levels interacts with local institutional conditions. Higher-level economic constraints (driven by austerity programmes from 2010 in Greece and devolution from 2010 in St Maarten) certainly exerted downward pressure on local risk management in all of the cases, squeezing priorities and human resources. However, these constraints worked to exacerbate pre-existing institutional conditions, such

as the institutional fragmentation and short-term political interests in tourist and land development experienced in all three cases. These institutional conditions also prevented higher-level, formal governance and regulatory frameworks from having any felt impact at the local level. This included the failure of the 2007 EU flood directive to embed in Rethymno and in St Maarten, the lack of purchase of Dutch land-use regulation ordinances dating back to the 1990s. The focus in our analysis of the role of local institutional conditions and responsibilities goes beyond existing descriptions in the relevant literatures of the local impacts of global and national economic and political changes as driven downwards by structural forces (e.g. Leichenko et al. 2010). On the other hand, the analysis does not imply we should focus exclusively on the workings of local institutions in order to understand disaster causation. The case studies reveal the interaction of local institutions with changes occurring at high spatial and temporal resolutions and the influence of this interaction on small-scale but high local impact risks. This demonstrates that processes occurring at higher scales are not just confined to impacts of large-scale, intensive events, as previous studies have shown (IRDR 2011). This suggests an even more widespread significance of findings to debates about distribution across scale of responsibility for risk reduction.

A politics of scale approach usefully illuminates the relational shifts in power that occur over scales to close or release access to resources, regulation and governance frameworks for risk reduction. In Rethymno and St Maarten, political and economic marginality from global, regional and national power was compounded by the closing of access to resources at higher scales from 2010 in both cases. This further pressurised local risk management capacities. A central finding of this paper, however, is to show that this relational politics of scale is not the only institutional politics at work. Indeed, informal political arrangements may in fact exert a stronger influence on local risk reduction pathways. Genoa is emblematic in this regard. Flood events in Genoa exert a stronger felt impact on higher-scale actors than in the other two case studies, releasing resources to the local level. This is revealing of its political, economic and demographic status. However, the power of size is double-edged and, when coupled with its informal politics, enables local actors to block the use of resources made available for risk reduction. Any advantages of size (Paterson et al. 2017) are inhibited.

Underpinning this, the temporal sequencing of events matters to politics (Pierson 2004). In part as a result of the timing and nature of relative institutional shifts of power, authority and resources, St Maarten was better able than Rethymno to withstand the impacts of the global/EU economic crisis (with support from the Netherlands and the EU available in 2008). The later loss of higher-level resources through the 2010 decentralisation reforms exacerbated the influence of historic marginalisation and local political clientelism on risk reduction efforts. Across all three cases, abrupt shifts in scalar responsibilities through policy reform met persistent – but not immutable – institutional conditions such as fragmentation and clientelism. The outcomes for risk reduction were produced in the interaction between these differing temporalities of change in institutions.

Analysis revealed the inter-connectedness of socio-economic and governance drivers and their non-linearity, as shifts in wider policy regimes drove positive and negative outcomes for risk reduction at the local scale. Understanding how this also relates to the materialities of hazard and physical change certainly matters. The degree of influence of hazard impacts on policy was affected by the degree of impact, being felt most strongly in St Maarten and Genoa after major disaster events that required national support. However, this was not a linear relationship - the politics of institutional change (such as decentralisation and austerity) also drove systems (Roland 2004). Within the risk and resilience field, this interaction between physical events and institutional processes of change creates a complex process of coevolution, neither driven solely through institutional hierarchies (Chelleri et al. 2015; Zaidi 2018) or contingent disaster impacts (Donovan 2017).

The analysis raises questions about whether decentralising power and resources down to the local is the most effective route to supporting local agency without commensurate change at other spatial scales,

and change in wider institutional practices (Blackburn 2014; Paterson 2017). The evidence indicates three mechanisms which influence interventions across scales: trade-offs, context and entry points.

First, trade-offs which occur when broader institutional conditions change. This is epitomised by the case of Genoa, where the strengthening of one system (regional and national anti-corruption legislation to avoid bribery in public spending) weakened the functioning of another (local physical mitigation works) with negative effects on risk exposure and vulnerability (Scolobig 2017). Contrary to other accounts of disaster-development trade-offs which assume that ‘good governance’ will reap rewards for disasters management, all good things do not always ‘go together’ (Tuhkanen et al. 2018).

Second, intervention at higher scales in the context of weak local institutions can still be partially effective for risk reduction. In St Maarten the flow of resources from national and regional institutions cushioned tensions between local economic development agendas – driven by uneven political interests – and risk reduction. However, it left systemic reform of local institutions unaddressed, marginalising community-led response.

Third, the dynamics of local agency, suggestive of entry points for risk reduction. Across all three case studies, changes in the parameters of local agency are shown to emerge endogenously - for example, owing to the activism of a local Mayor in Rethymno or the re-negotiation of statehood for St Maarten. Such parameters can also be influenced by national-level action, such as change in funding criteria for Genoa on the back of EU regulation. However, in Rethymno and St Maarten, in the context of local resource constraints, this only translated into action for risk reduction when local actions were aligned with resources and strategies occurring across scales. While changes in institutional practices were indicated to open possibilities for local risk reduction, these also had contradictory effects. This was the case with formal, institutional reform in Genoa (legal trials stalled mitigation works) and St Maarten (devolution and conditionality exacerbated trade-offs but might have increased accountability). Such a context of complexity means finding interventions that are ‘best fit’ for context, or adapting to the political context, as well as taking advantage of a plurality of solutions, operating flexibly and working at multiple levels simultaneously to tackle complex problems (Ramalingam et al., 2013).

v. Conclusion

Understanding causality “should be seen as a basic rationale for disaster risk research and in substantiating disaster risk reduction practice” (Oliver-Smith et al. 2016, p.2). This paper extends the theoretical lens, method and empirical base for doing so, using case studies of small-scale disasters to re-scale causal investigations and interrogate the institutional processes that drive the influence of distant conditions on local risks. The findings raise new questions about how to pursue research into disaster causation, with the paper calling for this to be based on a more explicit epistemology of causation. Going forward, there is much potential to enrich our social scientific understanding of disaster causation through greater engagement with the growing use of historical methods to uncover the role of path dependencies and inertia in influencing contemporary risks (Adamson 2018; Parsons 2019) and more explicit theorisation of policy processes (as scholars of sustainability transitions are starting to do, see Kern and Rogge 2018 and Roberts et al. 2018). Finally, the paper highlights a methodology for integrating causal analysis into risk assessment but also illustrates some of its complexities. This includes the scale of research that is required to present and corroborate a comprehensive view of causation. Going forward, this opens the possibility of a more encompassing analysis that can reach beyond the standard localised focus of formal risk assessments and begin to more fully address the question of risk causation, so that lessons and actions to reduce risk are more fully balanced across and between scales of government and their actions.

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